Eobrolgus spinosus

A gammarid amphipod

Phylum: Arthropoda, Crustacea
Class: Malacostraca
Order: Amphipoda, Gammaridea
Family: Phoxocephalidae

Taxonomy: The genera *Eobrolgus* and *Foxiphalus* were designated in 1979 by Barnard and included species formerly in the genus *Paraphoxus*, including *E. spinosus* (e.g. *Paraphoxus spinosus)* (Barnard and Barnard 1982).

Description

Size: Individuals to 4.5 mm in length (Puget Sound, Barnard 1960). The largest Oregon specimens were 3.5 mm (Coos Bay) and 2.4 mm (Yaquina Bay) (Kemp et al. 1985). Ovigerous females are not longer than 5 mm (Barnard 1975).

Color: White, with black eyes.

General Morphology: The body of amphipod crustaceans can be divided into three major regions. The **cephalon** (head) or cephalothorax includes antennules, antennae, mandibles, maxillae and maxillipeds (collectively the **mouthparts**). Posterior to the cephalon is the **pereon** (thorax) with seven pairs of pereopods attached to pereonites followed by the **pleon** (abdomen) with six pairs of pleopods. The first three sets of pleopods are generally used for swimming, while the last three are simpler and surround the telson at the animal posterior. Members of the gammarid family Phoxocephalidae are referred to as “spiny heads” due to their shield-like pointed rostrums. They are also one the most abundant and diverse group of crustaceans in this size range (1–10 mm, Chapman 2007). Unlike many amphipod groups, taxonomic keys tend to favor female specimens in the Phoxocephalidae (Chapman 2007).

Cephalon: Head tapers evenly and is not abruptly narrowed (Fig. 2) with length about as long as pereonites one through three (Barnard 1975) (Fig. 1).

Rostrum: Rostrum well developed and not constricted (*Eobrolgus,* Barnard 1979) (Fig. 1).

Eyes: Large, black and about same size in females (Figs. 1, 2) and immature males, but is much larger in mature males (not figured).

Antenna 1: Female first antenna equal in length to second antenna. Flagellum has about seven articles (Fig. 3a) and accessory flagellum (in both sexes) is with about five articles.

Antenna 2: The peduncle of the second antenna in females is with some heavy spines and setae (Fig. 3b). The flagellum has about seven slender articles, and is shorter than the peduncle (Barnard 1960). The male flagellum is longer than the body in mature males and can have sensory clubs on proximal flagellal articles and on fifth peduncle articles (not figured). Immature males have flagella a little longer than peduncle.

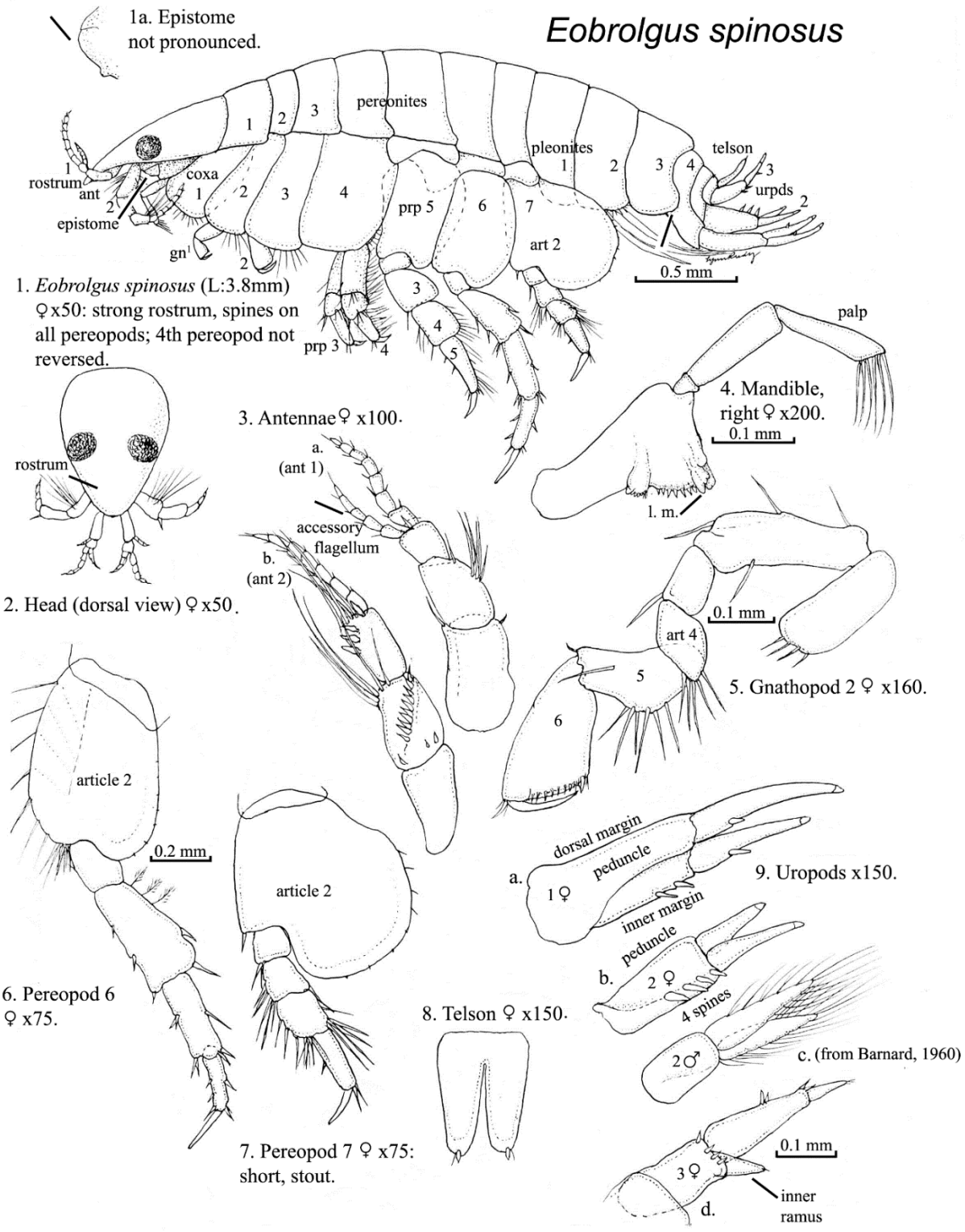
Mouthparts: Epistome (a part of the lip) is not produced into cusp (Fig. 1a) (Barnard 1960). The Phoxocephalidae is one of few groups in which epistome is of taxonomic importance. For a lateral view, push antennae and mandibular palps aside (Barnard 1960). Mandible with tri-articled palp, feeble molar and no large process. Right female mandible is with simple lacinia mobilis (Barnard and Barnard 1981) (Fig. 4). The first maxilla is with biarticulate palp and an outer plate with nine spines (Barnard and Barnard 1981). Maxilliped palp of article four is without large distal setae (not figured).

Pereon:

Coxae: Coxal plate one almost as large as two. The fourth coxa is broad and the fifth rounded (Fig. 1). Coxal margins bear simple setae.

Gnathopod 1: Small. Similar in size and shape to the second gnathopods (*Eobrolgus,* Barnard 1979). Article six is broad.

Hiebert, T.C. 2015. *Eobrolgus spinosus. In:* Oregon Estuarine Invertebrates: Rudys' Illustrated Guide to Common Species, 3rd ed. T.C. Hiebert, B.A. Butler and A.L. Shanks (eds.). University of Oregon Libraries and Oregon Institute of Marine Biology, Charleston, OR.



Gnathopod 2: Much like first gnathopods. The first article is not pronounced (i.e. with even margins) and the sixth article is broad.

Pereopods 3 through 7: Pereopods with stout spines (Figs. 1, 6, 7). Pereopod four "normal" in orientation, not reversed like pereopods 5–7 (Barnard 1975) (see *Eohaustorius estuarius*). Pereopod five with second article broad, articles 4–5 expanded but narrower than article two (Fig. 1). Pereopod six is longer and more slender and with narrower article two than pereopod seven (Fig. 6). Pereopod seven is shorter, stouter and with article two broader than pereopod six and has rounded posterior edge with fine spines, no large spur (Fig. 7).

Pleon:

Pleonites: Fourth pleonite with proximal edge strongly depressed in males, while the edge is almost flush with segment three in females (*Eobrolgus,* Barnard 1960).

Urosomites: First urosomite peduncle with at least one dorsal margin, with only one or no spines and two spines on inner peduncle margin. Inner and outer branches similar, with one apical and one margin spine (Fig. 9a). Second uropods in females with four stout spines on peduncle margin, rami shorter than peduncle and without marginal spines (Fig. 9b) (Barnard 1960). In males, there are more spines on peduncle (not figured). The third uropods in females is with inner ramus half as long as (or slightly less than) outer (Fig. 9d). In males, the inner ramus is more than half as long as the outer and is quite setose in mature specimens (Fig. 9c) (Barnard 1960).

Epimera: The third epimeron is not produced into a tooth and is naked (i.e. bears no setae) (Barnard and Barnard 1981) (Fig. 1).

Telson: Teslon, with cleft, is thin, lamellar and each lobe is with one short spine and one fine seta (Fig. 8).

Sexual Dimorphism: Not as strong as in some amphipod families. Males have larger **eyes**, much longer second **antennae** and spinose uropods (uropod three). Usual amphipod gnathopod sexual dimorphism is not observed in this genus (Barnard 1960; Chapman 2007)**.**

Possible Misidentifications

Phoxocephalids can be distinguished primarily by their sixth and seventh pereopods, which are greatly different from each other. They also have distinctive multiarticulate accessory flagellae (on antenna one), and long rostrums (Barnard 1960). Hyalidae and Dogielinotidae are also estuarine families, but they lack mandibular palps and inner rami on the third uropods. The Pleustidae have uncleft telsons and only vestigial antennal accessory flagella (Barnard 1975). Both the Gammaridae and Haustoriidae have pereopods that are similar in size and shape (not like the Phoxocephalidae) and in these families, pereopod four is reversed. Gammaridae have a telson with connected lobes (see *Eogammarus confervicolus),* while the telson lobes of Haustoriidae are disjunct (see *Eohaustorius estuarius),* and are much heavier than those of *Eobrolgus.*

The Phoxocephalidae is a diverse and abundant group of amphipods with 13 genera (comprising 30–45 species) represented locally including, *Mandibulophoxus* (one local species)*, Cephalophoxoides* (one local species), *Heterophoxus*, (five local species), *Majoxiphalus* (one local species), *Metaphoxus* (one local species), and *Parametaphoxus* (one local species). Most phoxocephalid species formerly in *Paraphoxus* have been placed (by Barnard 1979) into one of six genera including *Metharpinia* (two local species), *Eyakia* (one local species)*, Foxiphalus* (seven local species)*, Grandifoxus* (three local species)*, Rhepoxynius* (19 local species)*,* and *Eobrolgus* (two local species).

Mandibulophoxus is distinguished from *Eobrolgus* by its sickle-shaped mandibular palp borne on a large process. It has a biarticulate palp on the first maxilla (like *Eobrolgus). Mandibulophoxus gilesi* is an eyeless, long-rostrumed species that has been found subtidally (to 14 meters depth) in Yaquina Bay and other Oregon estuaries (Chapman 2007).

Eobrolgus chumashi is an endemic oceanic species whose range probably extends only south of Oregon (Barnard and Barnard 1981). Its body is dwarfed and the head and eyes are large. The pleonal

epimeron are not naked as in *E. spinosus,* but have 1–2 ventral setae. The lacinia mobilis (on the right mandible of the female) is bifid, not simple. Some hybridization between these two species of *Eobrolgus* may occur (Barnard and Barnard 1981; Chapman 2007).

The genera *Foxiphalus* and *Eobrolgus* are morphologically similar. Female *Eobrolgus* have a short second article on antenna one with a ventral surface that is continually covered with setae. Female *Foxiphalus*, on the other hand, have a gap on the ventral side of antenna one. Confusingly, *Eobrolgus* males exhibit similar morphology of antenna one to *Foxiphalus* females and, thus, cannot be differentiated (Barnard and Barnard 1982) and, furthermore, *Foxiphalus* species are difficult to distinguish from *Majoxiphalus* (Chapman 2007). *Foxiphalus major* is probably the species most similar to *Eobrolgus spinosus.* Adults are larger than those of *E. spinosus* and ovigerous females are over 6 mm in length, but not under 5 mm. *Foxiphalus major* amphipods have longer heads and smaller eyes than do *E. spinosus* and their fifth pereopod is slender, not stout. The inner ramus of the female third uropod is more than ½ the length of the outer ramus (not less than ½, Fig. 9d). The third pleonal epimeron is concave or straight on its posterior edge and setose. *Foxiphalus major* was found under its old name (*Pontharpinia obtusidens)* on Oregon's outer coast (Barnard 1954, 1979).

Rhepoxynius tridentatus and others of this genus have an abruptly narrowing, untapered rostrum and the second article of pereopod seven has three large teeth on the posterior edge (Barnard 1954, 1979). *Rhepoxynius abronius,* with a broad head and narrow, short rostrum, has a long, sharp epistomal process. This species has large teeth on the posterior edge of pereopod seven. It has been reported from Yaquina Bay, Oregon.

Grandifoxus grandis (= Grandifoxus milleri and *Paraphosux milleri)* is found in the Columbia River estuary. This closely related species has a narrow gnathopod hand (sixth article) and an abruptly narrowing rostrum (Barnard 1960, 1979).

Ecological Information

Range: Type locality is New England (Homes 1905; Barnard and Barnard 1982). Known range includes the western Atlantic, from which it may have been introduced to the eastern Pacific. Distribution along the west coast of North America now includes Puget Sound, Washington to Newport Bay, California (Barnard and Barnard 1981).
Local Distribution: Coos Bay sites in South Slough, at Jordan Cove and at Pigeon Point (Barnard 1975). Other Oregon estuaries include Yaquina Bay.
Habitat: A burrower in sandy and muddy bottoms of estuaries that also tolerates substrates mixed with wood chips (e.g. Jordan Cove, Coos Bay). Phoxocepahlid amphipods are sensitive to a variety of pollutants and are common subjects of toxicity tests (e.g. *Rhepoxynius abronius*, Robinson et al. 1988).
Salinity: Collected at salinities of 30 (Coos Bay).
Temperature:
Tidal Level: High and mid intertidal (Coos Bay) (Chapman 2007).
Associates: In beds of the ghost shrimp, *Neotrypaea,* and with the polychaetes, *Pygospio elegans* and *Pseudopolydora kempi,* outside of shrimp beds (Coos Bay, South Slough) (Posey 1985).
Abundance: Phoxocephalid amphipods are highly abundant, reaching densities up to 700 individuals per square meter in California (Oakden 1984). Dominant invertebrate at Jordan Cove, Coos Bay. Recorded June abundances: lower intertidal (+0.9 meters MLLW) 60–162 individuals per 13 x 15 cm core; mid intertidal (+1.0 meters MLLW) 92–174 individuals; high intertidal (+1.1 meters M LLW) 37–58 individuals (Posey 1985). Generally not as abundant as its close relative, *Foxiphalus major* (Barnard 1960).

Life-History Information

Reproduction: Most amphipods have separate sexes with some sex determination correlated with environmental conditions (Straude 1987). Females brood embryos in an external thoracic brood chamber and create a water flow by moving their pleopods to irrigate embryos. Development within this brood chamber is direct and individuals hatch

as juveniles that resemble small adults, with no larval stage. Little is known about the reproduction and development of *E. spinosus*, but the development of another phoxocephalid species, *Rhepoxynius abronius,* has been described (Slattery 1985; Kemp et al. 1985) and proceeds with few, large eggs per brood (e.g. 5–12 eggs per brood, Slattery 1985 and 4–16, Kemp et al. 1985). Individuals of *R. abronius* breed in winter months and females are ovigerous in late winter and early spring in Monterey, California and beginning in October in Yaquina Bay, Oregon (Kemp et al. 1985). Egg size is approximately 460 µm and, upon hatching, are approximately 1.0 mm (Slattery 1985).

Larva: Since most amphipods are direct developing, they lack a definite larval stage. Instead this young developmental stage resembles small adults (e.g. Fig. 39.1, Wolff 2014).

Juvenile: Sexual maturity is reached after 2–3 molts in the phoxocephalid species, *Rhepoxynius fatigans,* and *R. abronius* (Slattery 1985), which, in *R. abronius,* is when individuals are approximately 2.7 mm in length (Kemp et al. 1985).

Longevity: Up to one year (Slattery 1985; Chapman 2007).

Growth Rate: Amphipod growth occurs in conjunction with molting where the exoskeleton is shed and replaced. Post-molt individuals will have soft shells as the cuticle gradually hardens (Ruppert et al. 2004). Growth rate of *Rhepoxynius abronius* new recruits was 0.3 mm per month (Kemp et al. 1985).

Food: Many phoxocephalids are detritivores, but some are also predators of larval polychaetes, and their grazing may affect community structure (Kemp et al. 1985). *Eobrolgus spinosus* is a common predator of small meiofaunal invertebrate taxa (e.g. larval, juvenile and adult polychaetes, nematodes, Oliver et al. 1982; Oakden 1984; Chapman 2007).

Predators: Fish, shorebirds.

Behavior: Males positively phototropic and attracted to night light, a trait that may be correlated with very large eyes.

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